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## IN THE SPECIFICATION

Please replace or delete the following paragraphs:

**Replace the paragraphs beginning on page 4, line 24 and continuing to page 4, line 31 with the following paragraphs:**

Figure 11 is a flowchart that illustrates the process whereby a user may retrieve provisioning and path protection state information for path protection groups;

Figure 12 is a conceptual block diagram that illustrates the constituent components of template displayed for a UPSR cross-connection;

Figure 13 is a conceptual block diagram that illustrates the components of a template displayed for the establishment of a cross-connection;

Figure 14 is a conceptual block diagram that illustrates the assignment of path protection group names for a UPSR application;

**Replace the paragraphs beginning on page 5, line 1 and running through page 5, line 3 with the following paragraphs:**

Figure 15 is a conceptual block diagram that illustrates ~~a logical ring application of the integrated NE~~ the assignment of path protection group names for a logical ring application; and

Figure 16 is a conceptual block diagram that illustrates ~~with the integrated NE~~ the assignment of path protection group names for a BLSR ring interworking application.

**Replace the paragraphs beginning on page 9, line 2 and running through page 8, line 21 with the following paragraphs:**

The Point-to-Point atomic cross-connection topology 200 consists of only one leg. (In-Out). (A leg is a one-way connection provisioned from one logical input tributary to one logical output tributary.) Note that a two-way point-to-point cross-connection consists of two point-to-point atomic cross-connections at the same cross-connection rate and in opposite directions between two tributaries. Although a two-way point-to-point connection can be established or removed with

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a single command, it is not atomic because each direction can be established or removed (or converted to another topology) independently. The point-to-point atomic cross-connection topology has a reported leg or a leg pair 1way, 2way.

The Path-Protected atomic cross-connection topology 202 consists of one path protection group with two legs, a working leg (In1-Out) and a protection leg (In2-Out). A cross-connection with this topology has two logical input tributaries and one logical output tributary. The path protection group is established or removed as part of this cross-connection topology, and it provides path-level protection switching for all the constituent signals carried by the cross-connection. (With fixed-rate tributary operation, there is only a single constituent signal carried by any cross-connection, whose rate matches the signal rate. However, with adaptive-rate tributary operation, a cross-connection can carry more than one constituent signal.) This topology is used in all applications involving path protection. The path-protected atomic cross-connection topology 200 has a reported leg or leg pair 1wayPS,W; 1wayPS,P.

The Adjunct Path-Protected atomic cross-connection topology 204 consists of two legs (adjunct legs) with the same rate and the same logical input tributaries as an existing path-protected cross-connection but a different logical output tributary. It differs from the path-protected atomic topology in that it does not include a path-protection group, and it depends on the existence of a path-protected cross-connection. This topology is used for applications where multiple outputs are needed from a single path protection group. For example, connection between two UPSR rings (SONET) or SNCP rings (SDH). This connection requires path selection to drop the circuit from the first ring and bridging to add the circuit into the second ring. Or, dropping traffic at many tributary interfaces in UPSR/SNCP ring, e.g. video distribution, the path-selected signal is dropped to multiple ports. A bridged path protected cross-connection involving separate path protection groups 206 selects and routes working leg in1 and protection leg In2 input traffic to ports 208 and 210. Path protected and adjunct path protected cross connections 212 employ a common path protection group to select and route working and protection legs to ports 208 and 210. The adjunct path-

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protected cross-connection topology 204 has a reported leg or leg pair  
1wayPA,W; 1wayPA,P.

Replace the paragraphs beginning on page 15, line 8 and running through page 15, line 17 with the following paragraphs:

~~Idle: working logical tributaries are connected to/from working port tributaries only, protection logical tributaries (protection access traffic) are connected to/from protection port tributaries~~

~~Ring switch: each working logical tributary on one ring side, either west or east, is bridged to and selected from a protection port tributary on the opposite ring side~~

~~Pass through: each protection port tributary is connected directly between opposite ring sides~~

Physical connections are made automatically to/from the working and protection tributaries in the physical ports (port tributaries), based on the user-provisioned cross-connection information (for logical tributaries) and the current state of the line protection switching:

Idle: working logical tributaries are connected to/from working port tributaries only, protection logical tributaries (protection access traffic) are connected to/from protection port tributaries

Ring switch: each working logical tributary on one ring-side, either west or east, is bridged to and selected from a protection port tributary on the opposite ring-side

Pass-through: each protection port tributary is connected directly between opposite ring-sides

Replace the paragraph beginning on page 21, line 19 with the following paragraph:


If, on the other hand, the port assignments are appropriate, the process proceeds from step 506 to step 514 where the controller determines whether there are unallowable conditions imposed by the system upon the selected ports.

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For example, if the ports have different rates, such as OC-48 and OC-12, and therefore can not protect one another. Or if the type of protection is not supported at this rate, such as the case when all ports are OC-3 but BLSR is not supported at OC-3. If there is an unallowable condition imposed upon a port, the process proceeds to step 508 and, from there, as previously described. If no unallowable conditions are imposed upon ports, the process proceeds to step 516, where the controller configures protection switching for the ports, depending upon the protection group type and whether the traffic is SONET or SDH. For example, if the group is a two-fiber BLSR, the controller configures protection for a two fiber BLSR/MS-SPRing; if the group is a SONET four fiber BLSR, the controller configures protection switching for a four-fiber BLSR; if the group is an SDH four fiber BLSR, the controller configures protection switching for four-fiber MS-SPRing, normal or transoceanic protocol, and so on.

Replace the paragraph beginning on page 22, line 16 with the following paragraph:



From step 522 the process proceeds to step 524, where the NE controller configures the physical working and protection tributaries in the assigned ports, based on their assigned west/east and/or working/protection roles. For a two fiber BLSR, half of the tributaries in each line are used as working and half are used as protection. From step 524 the process proceeds to step 526 where the NE controller identifies logical tributaries for each working input and output port tributary. That is, the controller assigns logical tributary behaviors to working input and output port tributaries. This operation is both a mapping and an identification of which port tributaries will have logical tributaries associated with them and which will not. Consequently, each tributary's behavior is based on how it is identified (e.g., whether to allow monitoring and cross-connections on the tributary and how to configure it in the next steps, depending if working or protection in certain types of groups). This assignment of logical tributary behaviors, this mapping of logical to port tributaries, permits a user to monitor and cross-connect from any port to any other port, using the abstraction of logical tributaries, thus

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freeing the user from the necessity of tracking details, such as switching status, whether a port associated with a particular port tributary is a member of a port protection group, what type of port protection group a port tributary is a member of, the state of protection switching, or other such details. The controller also assigns logical tributaries for each protection input and output port tributary, and the group is a two-fiber BLSR, a four fiber BLSR, or a 1XN (if the NE is configured to support protection access ~~and the group is 1XN~~ for this type of group).

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Delete the paragraphs beginning on page 28, line 21, and running through page 30, line 5.

Replace the paragraphs beginning on page 30, line 25 through page 30, line 31 with the following paragraphs:

The integrated NE supports a method of tributary addressing which:

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- a) is consistent for all user operations: cross-connections, path-level signal monitoring (provisioning and reporting), and path protection switching;
  - b) is independent of the type of line protection (network configuration) and the current protection switching state;
  - c) reflects the monitoring behavior provisioned for the tributary normally used to receive a circuit and also the current results for that circuit, regardless of the current protection switching state.

The flowchart of Figure 7 illustrates the process by which a user employs a command (ED-STS1 in this illustrative embodiment) to modify the provisioning (such as the Bit Error Rate threshold used for path level monitoring) for a logical tributary. The process begins in step 700 and proceeds from there to step 702 where the integrated NE controller receives the ED-STS1 command. The process then proceeds to step 704 where the controller identifies the port and tributary for which the user is modifying the provisioning. From step 704 the process proceeds to step 706 where the controller determines whether the optical port is a member of a port protection group. If the port is not a member of a port protection group the process proceeds to step 708 where the controller stores the bit error rate

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(BER) threshold value in memory and applies the threshold to the physical port tributary identified in step 704. From step 708 the process proceeds to end in step 710.

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If the controller determines in step 706 that the optical port is a member of a port protection group, the process proceeds to step 712 where the controller determines whether the group is a two-fiber BLSR and, if so, the process proceeds to step 714 where the controller determines whether the tributary is working or protection. If the tributary is a working tributary the process proceeds to step 716 where the controller stores the threshold value in memory and applies the threshold value to the physical port tributary identified in step 704. In step 716 the controller also applies the threshold to a protection port tributary in the port protection group whenever it is currently being used to carry the working traffic that is normally carried on the identified working tributary. From step 716 the process proceeds to end in step 710. If, in step 714 the controller determines that the tributary is a protection tributary, the process proceeds to step 715 where the controller determines whether the protection access feature is supported within the port protection group identified in step 706 and, if so, the process proceeds to step 717 where the processor stores the threshold value in memory and applies the threshold to the physical port tributary identified whenever it is not currently preempted and being used to carry traffic that is normally carried on a working tributary. When a protection tributary is preempted and being used to carry working traffic by a ring or span switching in a BLSR group or by a line switch in a 1XN group, the threshold of the currently protected working tributary is used for monitoring instead. However for a BLSR ring switch with this node in the pass-through state, no threshold or monitoring applies. From step 717 the process proceeds to end in step 710. If, in step 715 the controller determines that protection access feature is not supported in this group type, the process proceeds to step 730 where an error is flagged since no logical tributary is associated with the identified tributary and it cannot be addressed for this operation. From step 730 the process may await further user input or proceed to end in step 710.

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If the controller determines in step 712 that the port protection group is not a two-fiber BLSR, the process proceeds to step 718 where the controller determines whether the group is a four-fiber BLSR and, if it is, the process proceeds to step 714 and from there as previously described. If in step 718 the controller determines that the group is not a four-fiber BLSR, the process proceeds to step 720 where the controller determines whether the group is a 1XN port protection group and, if so, the process proceeds to step 714 and from there as previously described. If the controller determines in step 720 that the group is not a 1XN port protection group, the process proceeds to step 722 where it determines whether the group is a 1+1 protection group and, if not, it proceeds to step 728 where it flags an error and then to end in step 710. If the controller determines in step 722 that the group is a 1+1 protection group, the process proceeds to step 724 where the controller determines whether the tributary is working or protection. If the tributary is protection, the process proceeds to step 730 and from there as previously described. If the tributary is working, the process proceeds from step 724 to step 726 where the controller stores the threshold value in memory and applies the threshold value to the physical port tributary identified in step 704. In step 726 the controller also applies the threshold to the protection port tributary in the port protection group which also carries the traffic of the working tributary identified. From step 726, the process proceeds to end in step 710.

Replace the paragraph beginning on page 33, line 12 with the following paragraph:

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The AID for a port protection group identifies the group by its type (e.g., "F" for Four-fiber BLSR) and by a 2-digit ID number which is unique for that type of group in that shelf. The ID number is assigned by the user when the group is established, and cannot be changed. The type determines the applicable content of the ring-side and line in the AID. The examples in Figure 4 illustrate the AID structure containing the port protection group, ring-side and/or line, slot, and port. The AID structure for tributaries is not shown here but is the same except for the tributary number appended at the end. The AID of a port tributary and the AID of a

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logical tributary are differentiated by the context (commands). The AID of a logical tributary can be used also to identify (depending on the context): an input or output of a cross-connection leg; an input/output constituent signal; a path protection group; or a constituent path selector. The integrated NE architecture allows any supported type of port unit in any slot, and each port unit may have a different number of ports. The integrated NE architecture allows port protection groups of various types to be provisioned independently for the multiple ports per optical port unit and without unnecessary restrictions on slot location or on mixing within a shelf. Thus, the system can support the provisionable mixing of line protection (network topologies) and more than one ring even within the same shelf. Port and tributary addressing is ~~supporting~~ that supports a dual, physical/logical view of both the equipment in the network element and the bandwidth for a circuit in the network configuration enables easier, consistent operations in a system that supports flexibility in mixing network configurations. Other systems support physical equipment addressing only, or a mix based on having dedicated port unit slots for the one ring (logical) and for the other ports (physical).

**Replace the paragraph beginning on page 34, line 26 with the following paragraph:**

Returning to step 810, if the AID does not identify an existing slot and port only, the process proceeds to step 822 where the controller determines whether the AID identifies an existing port protection group and line only - in which case the AID does not identify a slot and port (e.g., 2-1-f01-ep-#-#, in which the fields for port protection group and line are filled with numbers, but the fields for slot and port are ~~filed~~ filled with pound signs), and, if so, the process proceeds to step 812 where the controller determines whether the AID also identifies an existing tributary.


**Replace the paragraph beginning on page 38, line 7 with the following paragraphs:**



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The conceptual block diagram of Figure 13 illustrates a template displayed for the establishment of a cross-connection. The template 1300 of Figure 13 includes the following steps:

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- 1) establish cross-connection by, for example, selecting an application from a list, the list including atomic cross-connections. For example, an add or drop operation in a UPSR or SNCP ring.
  - 2) select a cross-connection (XC) rate.
  - 3) select tributary AIDs, for the tributary labels in this application: where A equals "path 1N" and B equals "path 2" (default is corresponding tributary in opposite line) and C equals "Add/Drop."
  - 4) select a working input (A or B, the default is A in this example).
  - 5) add other information as needed, including cross-connect number.
  - 6) send three commands to the network element; namely, (a) establish a path-protected cross-connect, inputs from path 1 and from path 2, output to add/drop (A or B to C); (b) establish point-to-point cross-connect, input from add/drop, output to path 1 (C to A), (c) establish point-to-point cross-connect, input from add/drop, output to path 2 (C to B)

The template guides a user through six steps (discussed in greater detail in relation to the flow chart of Figure 9) to establish a cross-connection. The user interacts with the display to select cross-connection rate (step 2), the selection of tributary AIDs (step 3), the selection of a working input (step 4), addition of cross-connection number (and other information, as needed—step 5) and the sending of three commands to the NE (step 6).

The flowchart of Figure 9 illustrates the process whereby a user interacts with an integrated NE to establish a compound cross-connection for the "UPSR (or SNCP Ring) Add, Drop" application (The conceptual block diagram of Figure 13 illustrates the tributary usage and atomic cross connections established for the "UPSR(or SNCP Ring) Add/Drop" ~~application~~ application). The process begins in step 900 and proceeds from there to step 902 where the user interface (which may, for example, be a separate application program running on a standalone

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computer or a part of the controller) receives an indication to establish a cross-connection and proceeds from there to step 904. In step 904, the controller determines whether the cross-connection is for a UPSR (or SNCP Ring) Add, Drop application and, if so, the process proceeds to step 906 where the controller determines whether the user has selected valid tributaries for this application and, if so, the process proceeds to step 908 where the controller decomposes the compound cross-connection for this application into three atomic cross connection commands:

Replace the paragraph beginning on page 38, line 25, with the following paragraphs:

From step 908 the process proceeds to step 910 where the user interface transmits the commands to the portion of the NE controller which effects the commands. The user interface also forwards the cross-connection application, a unique cross connection number and user-selected parameters. From step 910 the process proceeds to step 912 where the NE controller establishes each atomic cross-connection and stores the cross-connection application code and the cross-connection number for each leg. From step 912 the process proceeds to end in step 914. If, in step 904 it is determined that another application is to be employed, the process proceeds from step 904 to step 916 where a similar validation process, for the application, with which may involve different compound cross-connections, is effected, and the process proceeds to step 910 and from there as previously described. If, in step 906, it is determined that the tributaries selected for the application are not valid, the process proceeds to step 918 where an error is flagged and, if there is no corrective action on the part of the user, the process proceeds to end in step 914.

The conceptual block diagram of Figure 12 illustrates the constituent components of a UPSR (or SNCP Ring Add/Drop cross connection. Tributary AIDs A, B, and C are matched with respective tributary labels "Path 1", "Path 2" and "Add/Drop".

1) XC Application = UPSR (or SNCP Ring) Add, Drop

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2) Expected Leg-PairsA', C', 2wayPS, WB', C', 2WAY Ps, PORA', C', 2wayPS, PB', C', 2WayPS, W3) Match Tributary AIDs (A', B', C') to the Tributary Labels in this application:A = "Path 1"B = "Path 2"C = "Add/Drop"4) Display fields:XC RateXC ApplicationAID "Path 1"AID "Path 2"AID "Add/Drop":Indicate the Working input ("Path 1" or "Path 2")Other XC parameters

The expected leg pairs are: A , C, 1wayPS,W; B,C,1wayPS,P; C,A, 1way; and C,B,1way. The user interface controller will also include the following display fields: cross connection rate and application, AID path 1, AID path 2, AID Add/Drop, an indication of the working input ("Path 1" or "Path 2") and other cross-connection parameters.

**Replace the paragraph beginning on page 39, line 17 with the following paragraph:**

From step 1006 the process proceeds to step 1008 where user interface determines whether all legs having a particular cross-connection number have the same cross connection application code and cross-connection rate. If so, the process proceeds to step 1010 where the user interface determines whether the application is UPSR (or SNCP Ring) ADD/DROP application. If so, the process

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proceeds to step 1012 where the user attempts to match the legs with the template for connections in this application:

- 1) 1-way path-protected, working leg: from path 1 to Add/Drop
- 2) 1-way path-protected, protection leg: from path 2 to Add/Drop
- 4) 3) 1-way point-to-point leg: from Add/Drop to Path 1
- 5) 4) 1-way point-to-point leg: from Add/Drop to Path 2

Replace the paragraphs beginning on page 41, line 14 and running through page 42, line 5 with the following paragraphs:

Turning now to the flowchart of Figure 11, the use of a command (RTRV-PRTN-GRP) by a user to retrieve provisioning and current path protection state for one or more path protection groups and their constituent path selectors is demonstrated. The process begins in step 1100 and proceeds from there to step 1102 where the controller receives the command. From step 1102 the process proceeds to step 1104 where the controller determines whether the command identifies the path protection group(s) by an AID, by a path protection group name, or both. In this illustrative embodiment, the AID of a path protection group is defined as the AID of its logical output tributary. If only an AID is employed, the process proceeds to step 1106 where the controller identifies the path protection group (if any) having this tributary as its output (or the set of groups having the tributaries in this port as their outputs). From step 1106 the process proceeds to step 1108 where the controller retrieves data for the identified set of path protection groups and, from there, the process proceeds to end in step 1110.

If, in step 1104 the controller determines that the command identifies the path protection group by a path protection group name, the process proceeds to step 1112 where the controller identifies the set of path protection groups(if any) having this path protection group name (e.g., the groups having inputs from the same pair of ports). From step 1112 the process proceeds to step 1108 and from there as previously described. If in step 1104 the controller determines that the command identifies the path protection group(s) by both an AID and a path protection group name(s) (that is, by path protection group name and logical input

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tributary that is, by a path protection group name and an AID defined in this case to represent a logical input tributary rather than a logical output tributary the process proceeds to step 1114 where the controller identifies the set of path protection groups (if any) having this path protection group name and this tributary as an input (e.g., the group(s) having inputs from the same pair of ports and a specific input tributary). From step 1114 the process proceeds to step 1108, and from there as previously described.

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Delete the paragraphs beginning on page 42 line 6 and running through page 42, line 18.

*A13*

Replace the paragraph beginning on page 42, line 19 with the following paragraph:

The conceptual block diagram of Figure 14 illustrates the assignment of path protection group names. The path protection group names may be assigned to each set of path protection groups which the user may want to operate together, and separately from other sets. Where only a single group with a particular connectivity between ports and a unique label\_(e.g., "c") is illustrated, this represents a set of path protection groups: one group for each of the STS-N/VC-N circuits using the tributaries of these ports.

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Replace the paragraph beginning on page 46, line 20 with the following paragraph:

□□Cross-Connection Rate: The attribute of a cross-connection that defines the path-level bandwidth that the cross-connection can carry. SONET rates include: STS-1, STS-3, STS-12, and STS-48. The corresponding SDH rates are: VC-3, VC-4, VC-4-4c and VC-4-16c. The manner in which this bandwidth is used, in terms of constituent signals, is determined by the provisioning of the associated input tributaries for either adaptive-rate (pipe mode) or fixed-rate operation. With adaptive-rate tributary operation, an STS-N cross-connection could have a single STS-Nc constituent signal or any mix of multiple lower-rate constituent signals

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(e.g., STS-1s and STS-3cs in an STS-12), consistent with the SONET standard. Transitions between these constituent signal rates can take place. The system adapts to the current concatenation state by auto-detection of the concatenation indicators in the signal. With fixed-rate tributary operation, the allowed constituent signal rate of the cross-connection is determined by the user-provisionable tributary rate. ~~With SONET ports provisioned for fixed rate operation, the only allowed constituents for an STS-1, STS-3 or STS-12 cross-connection from a fixed-rate port are STS-1, STS-3c or STS-12c, respectively.~~ In order to flexibly allow interworking between SONET and SDH ports in global applications, the system treats VC-3 and STS-1 cross-connection rates as identical and VC-4 and STS-3 cross-connection rates as identical. With SONET ports provisioned for fixed-rate operation, allowed constituents for an STS-1, STS-3, STS-12, or STS-48 cross-connection from a fixed rate port are STS-1, STS-3c, STS-12c or STS-48c, respectively.

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